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(12) # EUROPEAN PATENT SPECIFICATION

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(54) **Powder dispensing apparatus.**

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Description

This invention relates to an apparatus for transferring powder from a bulk supply to containers of smaller size, for example boxes and bags etc.

The transfer of powders from a bulk supply to smaller containers for marketing or storage is complicated by the fact that the flow characteristics of powders are very different from those of liquids. For example some powders tend to be sticky and flow only with difficulty whilst others may be of a very light and flocculent nature so that when they are poured into a container air which is displaced carries with it substantial quantities of entrained powder. This can cause fire hazards if the powder is flammable or financial loss and danger to health if the powder is expensive or toxic.

The filling of a large number of containers with powder from a bulk supply must for practical reasons be carried out rapidly and under conditions so that preferably the escape of powder is prevented or if this is not possible then efficient methods of powder recovery are employed. Various measures have been employed for the purposes of achieving this objective. For example one of these involves fitting the delivery end of a conduit extending from the bulk supply of powder to be transferred to the container to be filled with an inflatable annulus which can be inflated and made to grip and form an air-tight seal with the mouth of the container. A second conduit is then provided between external wall of the inlet conduit and the inflatable annulus through which displaced air containing entrained powder can pass on its way to a powder recovery station where powder can be recovered. In order to assist the process a draught created by an exhaust fan assists the removal of displaced air. However in order to avoid any excessive reduction in pressure within the container air from outside the container is allowed to enter the container through a third conduit and merge with the effluent stream of air leaving the container.

In this way an improvement has been effected in transferring powder. However this technique results in excessive quantities of powder being carried from the container to the removal recovery plant. Furthermore the conduit from the container to the plant tends to have powder deposited in it.

Prior European application 32481 (D1) discloses a container filling machine having a filling conduit surrounded by a suction conduit for removing air and entrained powder. Around the suction conduit ambient air can enter via passages. In prior British patent number 2 053 129 (D2) a container filling arrangement is provided in which the flow through a dust/powder extraction conduit is arranged to be at a lower level during normal container filling but to achieve a high level during container removal and closure.

The preamble of claim 1 is based on document (D1) above. The problem to be solved by the present invention in the face of documents (D1) and (D2) is to ensure that during removal of a bag or container from the filling head and the sealing of the container there is a maximum flow of air around the top of the bag reducing the possibility of escape of powder to atmosphere. Document (D2) does ensure this, but during normal filling the fan simply operates to draw a major part of air from atmosphere to an inlet and discharges again into atmosphere. This is both economically wasteful and technically wasteful.

The characterising portion of claim 1 emphasises that by using a constant speed fan (and it is clear that a fan operating at constant speed uses minimum power) and providing the plenum during general filling throws air in a flow around the container generally and ensures that any minor leakage is exhausted, the flow of air is then switched as appropriate from the plenum to the area around the top of the container and the filling head during disconnection and closure.

For the purposes of this invention the term "powder" is taken to include any solid material which is sub-divided into particles and the term includes granules, pellets and the like.

The apparatus can be used for filling containers such as sacks made of plastics and paper having flexible walls or other forms of containers such as lined drums and cartons having rigid walls although the precise design of the apparatus will depend upon the nature of the container. For example for the filling of bags the apparatus should be provided preferably with an inflatable annulus which acts radially on the inner surface of the bag. However when drums are to be filled the annulus should be arranged preferably to act axially on the rim of the wall of the drum.

The efficiency of the apparatus depends frequently on the manner in which the powder flows from the bulk supply to the container and in general measures to control the entry of the powder into the container are required. The nature of these will depend upon the physical characteristics of the powder to be handled. For example in the case of a powder which does not flow easily the apparatus is fitted preferably with a vibrating valve so as to ensure that the powder is maintained in a sufficiently fluid condition to enable it to flow. Other forms of transference include the use of an Archimedean or other form of screw conveyor.

The present apparatus is of special use when it forms part of a weighing machine. This can if desired be linked with a programming device which controls the supply of powder from a bulk supply to the container and interrupts the supply when a

predetermined quantity has been delivered. However the programming device can be omitted in which case the supply of powder will require to be discontinued manually when the required quantity has been delivered into the container.

This invention is illustrated but not restricted by the following drawings which are both side views taken in vertical section of two preferred forms of invention apparatus.

In Figure 1 a feed inlet (1) feeds powder from a bulk supply (not shown) into a conduit (2) which is made of highly resilient material comprising preferably a high proportion of natural rubber. The passage of powder (3) through conduit (2) is controlled by a constriction caused by a slide closure (4) which is connected to a slide plate (5). The slide plate is connected to a piston head which is made to reciprocate horizontally within air cylinder (6). The cylinder is supported by end brackets (7 and 8) on anti-vibration mountings (9 and 10). Bracket (8) has attached to it a front end bracket (12). The effect of bracket (12) and slide closure (4) is to produce a valve consisting of a nip within which the resilient conduit (2) can be squeezed and constricted. The valve can also be vibrated by vibrator (11) and the vibrations thus produced are communicated to the powder in the region of the nip and ensure that the powder is maintained in a readily flowable condition.

The discharge end (13) of conduit (2) is surrounded by an exhaust air duct (14) which communicates via an air control valve (15) to an exhaust fan (16) and also to a perforated plenum plate (17). Arranged concentrically round the first conduit (14) is a second conduit (18) one end of which communicates with the atmosphere whilst the other end (19) opens into the container. Inlet (19) and outlet (20) are juxtaposed and have a wall portion (25) which is common to both conduits (14 and 18). An inflatable annulus (21) made preferably from natural rubber is secured to the outer wall of conduit (18) and when inflated as shown in the figure it forms an air-tight seal with the inner wall of a bag (22) which is supported by column (23). The latter extends down to the base (24) of a weighing machine.

The operation of filling containers with the apparatus described above takes place in a number of stages the timing of which is controlled by a sequencing system not shown. During the filling stage valve (15) is adjusted so as to ensure that a very low rate of air flow is maintained through conduit (14). During this operation the rate of exhaustion by fan (16) is not reduced. Consequently the balance of the air being drawn into the system enters through plenum plate (17). The need to maintain a low air flow at this stage stems from the fact that a higher rate is liable to create a partial vacuum in the container and this has an adverse effect on the accuracy of the weighing of the container which takes place during the filling process. When this process has been completed annulus (21) is deflated preparatory to removal of the bag. Since the weighing has now also been completed valve (15) can now be adjusted so that there is a high rate of air flow through conduit (14) the effect of which is not only to remove any powder which may have been deposited in the conduit but also any powder which is suspended in the space above the layer of powder present in the container. Throughout the operation there is a draught through conduit (18) thus providing a barrier to the escape of powder into the atmosphere. The figure shows the state of the apparatus during one of its stages of operation. In this stage powder (3) is flowing down into container (2) through conduit (2). The flow is controlled by the valving effect produced by the cooperation of slide closure (4) and front end bracket (12) and the vibration of these two members by vibrator (11). Air is displaced from the container by the downwardly moving stream of powder and is drawn away through exhaust conduit (14) together with some entrained powder by fan (16). At the same time air is drawn into the second conduit (18) and directly it issues from outlet (19) it is sucked into opening (20) of the exhaust air conduit (14) without causing any significant disturbance to the powder in the container. In this way the stream of air within the conduit (14) can be made to be sufficiently vigorous to prevent powder becoming deposited in the conduit whilst at the same time the removal of excessive quantities of powder by the air stream is prevented. A further advantage of this arrangement is that the apparatus can be programmed to more accurately deliver a predetermined weight of powder to the container.

Fig. 2 illustrates the use of the present apparatus for delivery of powder into a drum having substantially rigid walls. A method by which this apparatus is used is similar to that described for the apparatus described in Figure 1. The discharge end (13) of conduit (2) communicating with a bulk supply of powder (not shown) is positioned above the mouth of drum (22). There is arranged concentrically round conduit (2) an exhaust air duct (14) which as in Figure 1 communicates with an air control valve (15) and an exhaust fan (not shown). Sealing of the apparatus to the drum (2) is by means of an inflated annulus (21) which is made of preferably natural rubber and which presses down axially onto the rim (26) of the wall of drum (22). Conduit (18) enables a stream of air to enter the container when the exhaust pump is in operation and valve (15) is set to allow communication between exhaust air duct (14) and the fan. The entry aperture (27) of conduit (18) and the exit aperture

of exhaust air duct (14) are juxtaposed and a part of the walls of both duct (14) and conduit (18) are common to one another. As a consequence when the filling operation is taking place a sufficiently vigorous stream of air can be maintained through the drum over the surface of the powder already delivered without any serious disturbance of the powder. At the same time accumulation of powder in exhaust duct (14) is prevented.

Claims

1. Apparatus for transferring a powder (3) from a bulk supply to a container (22) comprising a first conduit (2) extending from the bulk supply to the container (22) a sealing means (21), arranged round the end of the first conduit (2) and adapted to enter into air-tight engagement with the wall of the container (22), a second conduit (14) having an opening (20) within the container (22) for allowing escape of air displaced from the container (22) when the powder (3) is being discharged from the first conduit (2) into the container (22) the second conduit (14) communicating with suction means (16) to assist removal of displaced air and a third conduit (18) enabling a stream of air to be drawn by the suction means (16) from outside the apparatus and to discharge from an orifice (19) within the container (22) the orifice (19) being in close proximity to the opening (20) within the container of the second conduit (14), characterised in that said suction means (16) is also connected to a plenum (17) arranged and disposed to draw air and any entrained powder from the vicinity of the container (22), control means (15) being provided capable firstly of ensuring that during filling there can be a low flow rate through the second conduit (14) and so that during container removal there can be a high flow rate through the second conduit (14) and secondly of ensuring that the flow of air from the plenum (17) varies inversely with variation of the flow through conduit (14).

2. Apparatus as claimed in claim 1 wherein the control means is a flow-proportioning valve and the suction means (16) is of constant output.

3. Apparatus as claimed in claims 1 or 2, wherein the sealing means is an inflatable annulus adapted to enter in air-tight engagement radially with the wall of a container having a flexible wall.

4. Apparatus as claimed in claim 1 or 2 wherein the sealing means is an inflatable annulus is adapted to enter into engagement axially with the rim of a wall of a container having a rigid wall.

5. Apparatus as claimed in any preceding claim wherein means are provided to control the flow of powder into the container.

6. Apparatus as claimed in claim 5 wherein the control means is a vibrating valve.

7. An apparatus as claimed in claim 5 wherein the control means is a screw conveyor.

Patentansprüche

1. Vorrichtung zur Weiterbeförderung von Pulver (3) von einer Schüttgutzufuhr auf einen Container (22), der eine erste Leitung (2), die sich von der Schüttgutzufuhr zum Container (22) erstreckt, eine Abdichtvorrichtung (21), die um das Ende der ersten Leitung (2) herum angeordnet und so ausgelegt ist, daß sie mit der Wand des Containers (22) in einen gasdichten Eingriff tritt, eine zweite Leitung (14), die eine Öffnung (20) im Container (22) aufweist und die es ermöglicht, daß Luft entweichen kann, die vom Container (22) abgelassen wird, wenn das Pulver (3) von der ersten Leitung (2) in den Container (22) entladen wird, wobei die zweite Leitung (14) mit einer Saugvorrichtung (16) in Verbindung steht, um bei der Entfernung der abgelassenen Luft mitzuwirken, und eine dritte Leitung (18) umfaßt, die es ermöglicht, daß ein Luftstrom durch die Saugvorrichtung (16) außerhalb der Vorrichtung angesaugt und von einer Austrittsöffnung (19) im Container (22) abgelassen wird, wobei sich die Austrittsöffnung (19) nahe an der Öffnung (20) der zweiten Leitung (14) im Container befindet, **dadurch gekennzeichnet,** daß die Saugvorrichtung (16) auch mit einem Ansaugraum (17) verbunden ist, der zum Ansaugen von Luft und mitgerissenem Pulver nahe am Behälter (22) ausgelegt und angeordnet ist, daß eine Regeleinrichtung (15) vorgesehen ist, die erstens gewährleisten kann, daß während des Füllens der Durchfluß durch die zweite Leitung (14) niedrig ist, so daß, während der Container entfernt wird, die Durchflußleistung durch die zweite Leitung (14) hoch ist, und die zweitens gewährleisten kann, daß der Luftstrom vom Ansaugraum (17) mit der Änderung der Strömung durch die Leitung (14) in Umkehrrichtung strömt.

2. Vorrichtung gemäß Anspruch 1, in der die Regeleinrichtung (15) ein Strömungs-Zumeßventil

ist, und die Saugvorrichtung (16) eine konstante Leistung hat.

3. Vorrichtung gemäß Anspruch 1 oder 2, in der die Abdichtvorrichtung ein aufblasbarer Ring ist, der so ausgelegt ist, daß er mit der Wand eines Containers, die elastisch ist, radial in einen gasdichten Eingriff tritt.

4. Vorrichtung gemäß Anspruch 1 oder 2, in der die Abdichtvorrichtung ein aufblasbarer Ring ist, der so ausgelegt ist, daß er mit dem Rand der Wand eines Containers, die starr ist, axial in Eingriff tritt.

5. Vorrichtung gemäß einem der vorhergehenden Ansprüche, in der eine Vorrichtung zum Regeln der Strömung des Pulvers in den Container vorgesehen ist.

6. Vorrichtung gemäß Anspruch 5, in der die Regeleinrichtung ein Vibrationsventil ist.

7. Vorrichtung gemäß Anspruch 5, in der die Regeleinrichtung ein Schneckenförderer ist.

Revendications

1. Appareil pour transférer une poudre (3) à partir d'une alimentation en vrac vers un réservoir (22), comprenant un premier conduit (2) qui s'étend entre l'alimentation en vrac et le réservoir (22), des moyens d'étanchéité (21) disposés autour de l'extrémité du premier conduit (2) et adaptés à entrer en contact étanche à l'air avec la paroi du réservoir (22), un deuxième conduit (14) ayant une ouverture (20) dans le réservoir (22) pour permettre l'échappement de l'air déplacé depuis le réservoir (22) lorsque la poudre (3) est en train d'être déchargée depuis le premier conduit (2) dans le réservoir (22), le deuxième conduit (14) communiquant avec des moyens d'aspiration (16) pour aider l'enlèvement de l'air déplacé, et un troisième conduit (18) permettant à un courant d'air d'être aspiré par les moyens d'aspiration (16) depuis l'extérieur de l'appareil et d'être évacué à partir d'un orifice (19) dans le réservoir (22), l'orifice (19) étant à proximité immédiate de l'ouverture (20) du deuxième conduit (14) dans le réservoir, caractérisé en ce que lesdits moyens d'aspiration sont aussi connectés à un collecteur d'aspiration (17), conçu et disposé pour aspirer de l'air et de la poudre entraînée au voisinage du réservoir (22), des moyens de contrôle (15) étant prévus pour premièrement garantir que pendant le remplissage, il puisse y avoir un faible débit dans le deuxième conduit (14), et tels que pendant l'enlèvement du réservoir, il puisse y avoir un grand débit dans le deuxième conduit (14), et deuxièmement pour garantir que le débit d'air provenant du collecteur d'aspiration (17) varie inversement avec la variation du débit dans le conduit (14).

2. Appareil selon la revendication 1, dans lequel les moyens de contrôle sont une vanne de réglage proportionnelle de débit, et les moyens d'aspiration (16) fonctionnent à débit constant.

3. Appareil selon la revendication 1 ou la revendication 2, dans lequel les moyens d'étanchéité sont un anneau gonflable adapté à entrer en contact étanche à l'air radialement avec la paroi du réservoir, qui présente une paroi flexible.

4. Appareil selon la revendication 1 ou la revendication 2, dans lequel les moyens d'étanchéité sont un anneau gonflable qui est adapté à entrer en contact axial avec le bord de la paroi du réservoir, qui présente une paroi rigide.

5. Appareil selon l'une quelconque des revendications précédentes, dans lequel des moyens sont prévus pour contrôler l'écoulement de poudre dans le réservoir.

6. Appareil selon la revendication 5, dans lequel les moyens de contrôle sont une vanne vibrante.

7. Appareil selon la revendication 5, dans lequel les moyens de contrôle sont un transporteur à vis.

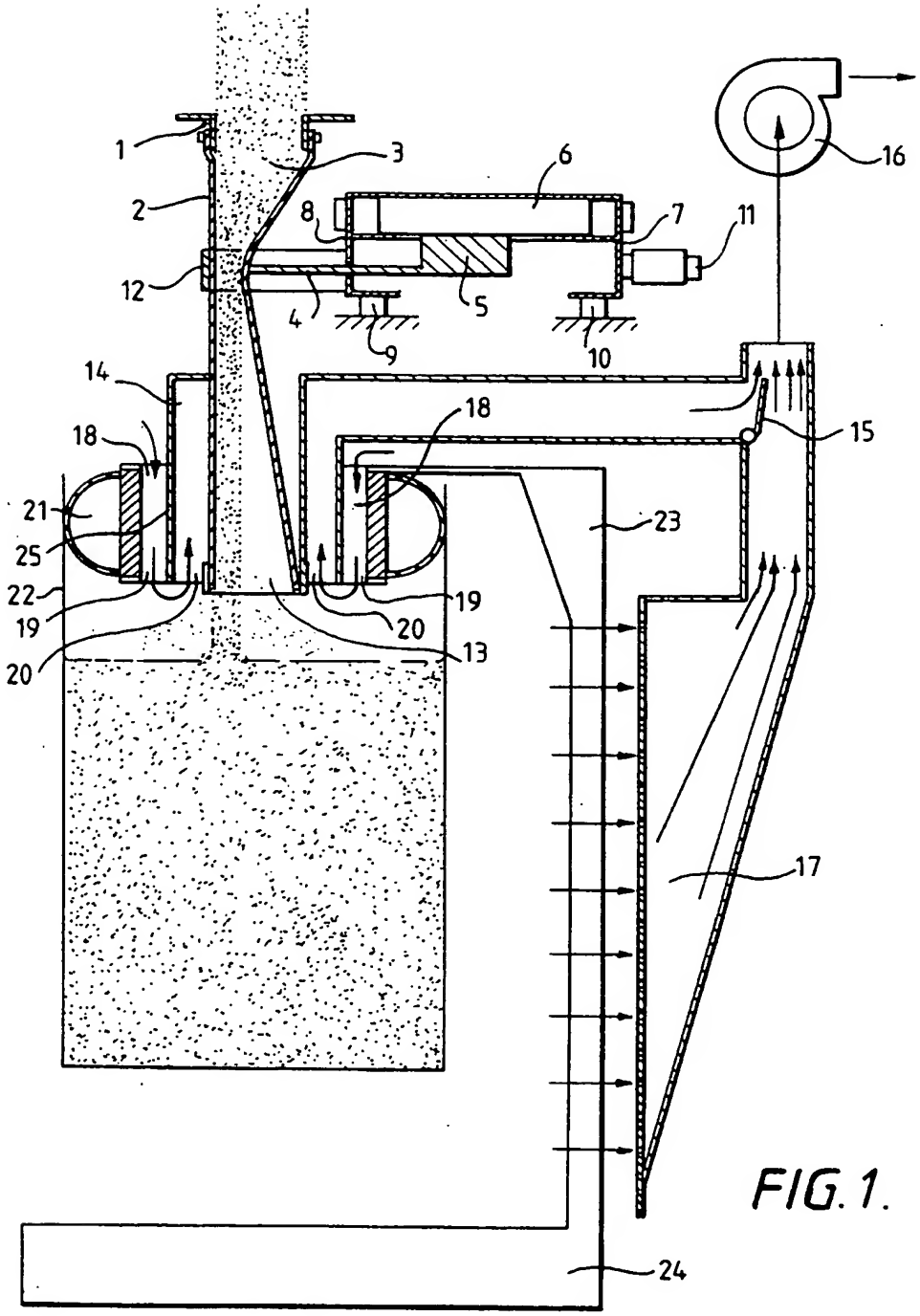

FIG. 1.

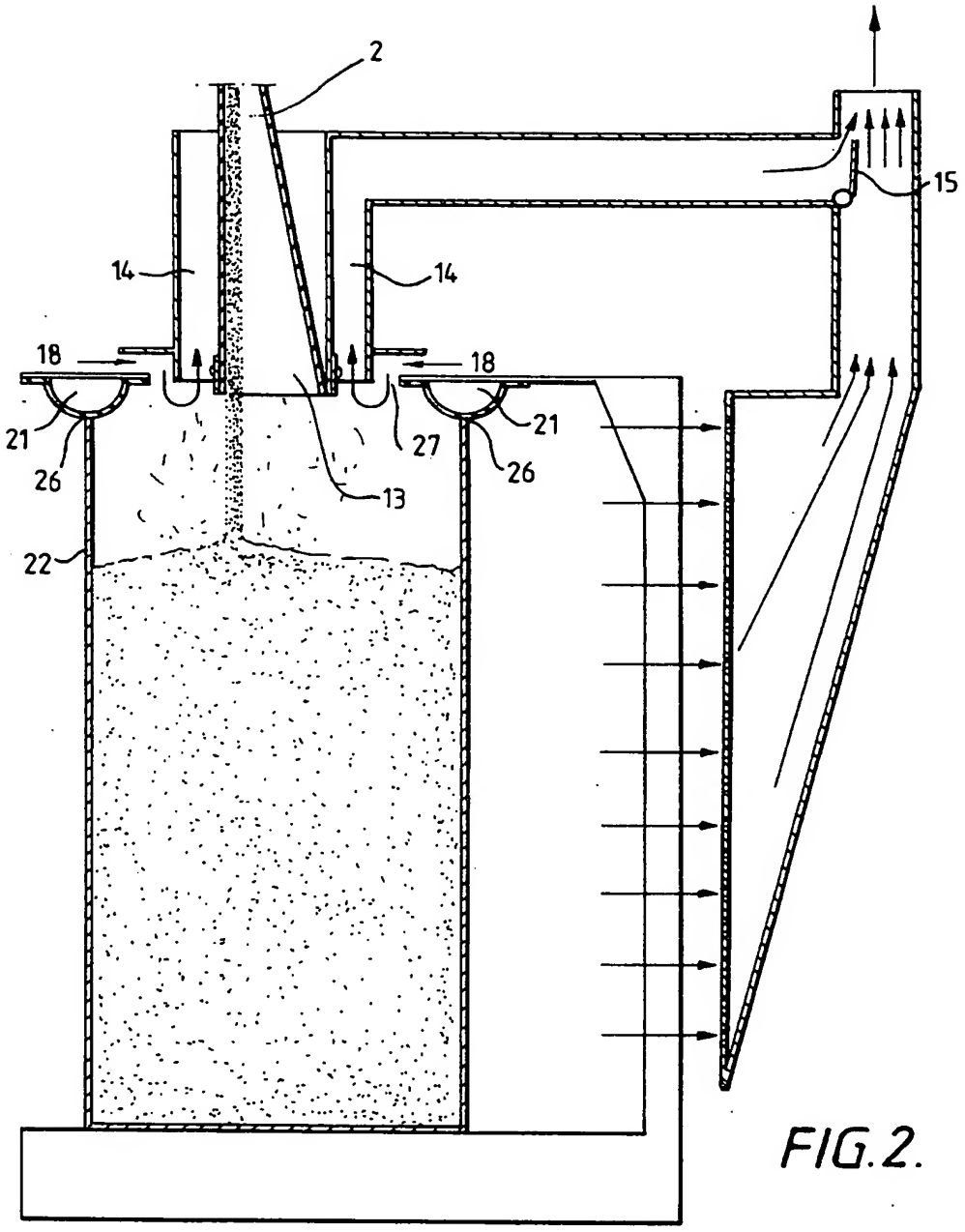

FIG.2.